Wind tunnel AER stats

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Get wind tunnel data only.
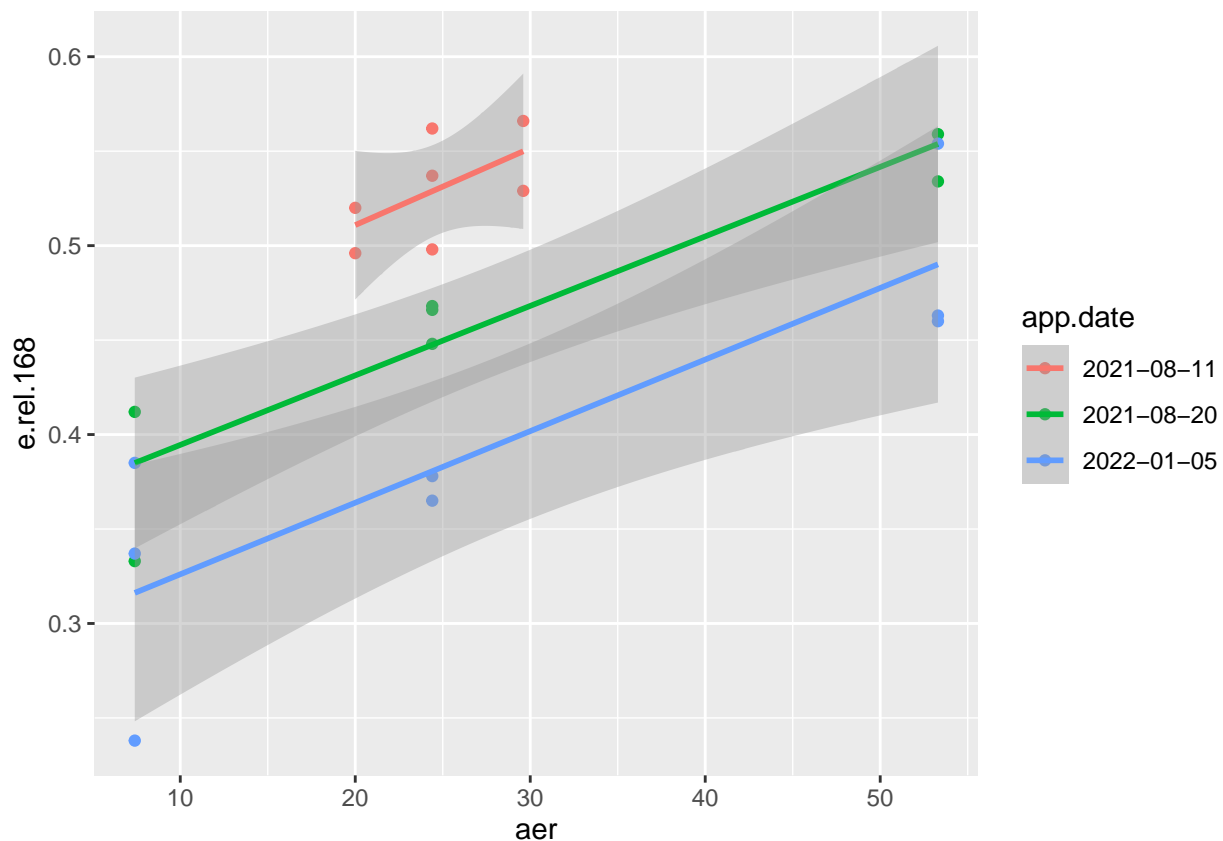
```
wsumm <- subset(isumm, meas.tech == 'Wind tunnel')
dfsumm(as.data.frame(wsumm))
```

```
##
##  22 rows and 23 columns
##  22 unique rows
##                    trial.nm    app.date     pmid   meas.tech meas.tech2      aer
## Class             character   character  integer   character  character  numeric
## Minimum            A 11 Aug  2021-08-11     1904 Wind tunnel         wt      7.4
## Maximum            C 05 Jan  2022-01-05     1925 Wind tunnel         wt     53.3
## Mean                   <NA>        <NA>     <NA>        <NA>       <NA>     27.2
## Unique (excld. NA)        3           3       22           1          1        5
## Missing values            0           0        0           0          0        0
## Sorted                 TRUE        TRUE     TRUE        TRUE       TRUE    FALSE
##
##                      aer.grp      cta air.temp.mean air.temp.min
## Class                 factor  numeric       numeric      numeric
## Minimum           Low 7 or 20      181          2.46         -3.4
## Maximum          High 30 or 54     211          15.4         11.4
## Mean               Medium 25       193          10.5         4.93
## Unique (excld. NA)         3         3             6            6
## Missing values             0         0             0            0
## Sorted                 FALSE     FALSE         FALSE        FALSE
##
##                  air.temp.max wind.2m.mean wind.2m.min wind.2m.max rain.cum
## Class                 numeric      numeric     numeric     numeric  numeric
## Minimum                   8.5          0.1         0.1         0.1        0
## Maximum                  22.3         0.72        0.72        0.72        0
## Mean                     17.1        0.367       0.367       0.367        0
## Unique (excld. NA)          6            5           5           5        1
## Missing values              0            0           0           0        0
## Sorted                  FALSE        FALSE       FALSE       FALSE     TRUE
##
##                  rain.cum.48 j.NH3.mean j.NH3.min j.NH3.max e.cum.final
## Class                numeric    numeric   numeric   numeric     numeric
## Minimum                    0     0.0763         0     0.431        16.1
## Maximum                    0      0.218    0.0309      3.54        39.4
## Mean                       0      0.165    0.0105       2.2        31.4
## Unique (excld. NA)         1         20        19        22          22
## Missing values             0          0         0         0           0
## Sorted                  TRUE      FALSE     FALSE     FALSE       FALSE
```

```
## 
##                 e.rel.final e.cum.168 e.rel.168
## Class               numeric   numeric   numeric
## Minimum               0.261      14.7     0.238
## Maximum               0.585      39.2     0.566
## Mean                  0.472      30.7     0.459
## Unique (excld. NA)       22        21        22
## Missing values            0         0         0
## Sorted                FALSE     FALSE     FALSE
## 
```

```r
ggplot(wsumm, aes(aer, e.rel.168, colour = app.date)) +
  geom_point() + geom_smooth(method = lm)
```

```
## `geom_smooth()` using formula 'y ~ x'
```



```r
m1 <- lm(e.rel.168 ~ aer + factor(app.date), data = wsumm)
summary(m1)
```

```
## 
## Call:
## lm(formula = e.rel.168 ~ aer + factor(app.date), data = wsumm)
## 
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.079013 -0.021060  0.002061  0.019678  0.067987
## 
## Coefficients:
```

```
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                0.4373544  0.0187755  23.294 6.83e-15 ***
## aer                        0.0037501  0.0005039   7.442 6.75e-07 ***
## factor(app.date)2021-08-20 -0.0816075  0.0199897  -4.082 0.000699 ***
## factor(app.date)2022-01-05 -0.1480920  0.0194106  -7.629 4.78e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03728 on 18 degrees of freedom
## Multiple R-squared:  0.8504, Adjusted R-squared:  0.8255
## F-statistic: 34.12 on 3 and 18 DF,  p-value: 1.227e-07
anova(m1)
```

```
## Analysis of Variance Table
##
## Response: e.rel.168
##                  Df  Sum Sq  Mean Sq F value    Pr(>F)
## aer               1 0.061325 0.061325  44.130 3.103e-06 ***
## factor(app.date)  2 0.080911 0.040456  29.113 2.283e-06 ***
## Residuals        18 0.025013 0.001390
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
confint(m1)
```

```
##                                   2.5 %       97.5 %
## (Intercept)                 0.397908439  0.476800373
## aer                         0.002691501  0.004808721
## factor(app.date)2021-08-20 -0.123604359 -0.039610631
## factor(app.date)2022-01-05 -0.188872193 -0.107311784
drop1(m1, test = 'F')
```

```
## Single term deletions
##
## Model:
## e.rel.168 ~ aer + factor(app.date)
##                  Df Sum of Sq      RSS     AIC F value    Pr(>F)
## <none>                        0.025013 -141.15
## aer               1  0.076972 0.101985 -112.23  55.391 6.749e-07 ***
## factor(app.date)  2  0.080911 0.105925 -113.39  29.113 2.283e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
m2 <- lm(e.rel.168 ~ aer * factor(app.date), data = wsumm)
summary(m2)
```

```
##
## Call:
## lm(formula = e.rel.168 ~ aer * factor(app.date), data = wsumm)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.078183 -0.020660  0.002845  0.020009  0.068817
##
## Coefficients:
```

```
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                0.4295161  0.1023309   4.197 0.000682 ***
## aer                        0.0040684  0.0041105   0.990 0.337024
## factor(app.date)2021-08-20 -0.0717983  0.1060734  -0.677 0.508155
## factor(app.date)2022-01-05 -0.1413697  0.1052222  -1.344 0.197845
## aer:factor(app.date)2021-08-20 -0.0003892  0.0041972  -0.093 0.927278
## aer:factor(app.date)2022-01-05 -0.0002796  0.0041692  -0.067 0.947363
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03952 on 16 degrees of freedom
## Multiple R-squared:  0.8506, Adjusted R-squared:  0.8039
## F-statistic: 18.22 on 5 and 16 DF,  p-value: 4.24e-06
```

```r
anova(m2)
```

```
## Analysis of Variance Table
##
## Response: e.rel.168
##                     Df   Sum Sq  Mean Sq F value    Pr(>F)
## aer                  1 0.061325 0.061325  39.266 1.125e-05 ***
## factor(app.date)     2 0.080911 0.040456  25.904 9.610e-06 ***
## aer:factor(app.date) 2 0.000025 0.000013   0.008     0.992
## Residuals           16 0.024988 0.001562
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
confint(m2)
```

```
##                                   2.5 %      97.5 %
## (Intercept)                 0.212584357 0.646447790
## aer                        -0.004645421 0.012782167
## factor(app.date)2021-08-20 -0.296663881 0.153067343
## factor(app.date)2022-01-05 -0.364430710 0.081691378
## aer:factor(app.date)2021-08-20 -0.009286814 0.008508499
## aer:factor(app.date)2022-01-05 -0.009117831 0.008558640
```

```r
drop1(m2, test = 'F')
```

```
## Single term deletions
##
## Model:
## e.rel.168 ~ aer * factor(app.date)
##                      Df  Sum of Sq      RSS     AIC F value Pr(>F)
## <none>                             0.024988 -137.17
## aer:factor(app.date)  2 2.5061e-05 0.025013 -141.15   0.008  0.992
```